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psychology in America, should claim in an editorial article in the last number of *The American Journal of Psychology* that he has accomplished nearly everything. The scientific and academic growth of psychology in America during the past fifteen years has been notable, but the cause must be sought chiefly in the progress of science as a whole and the sharper differentiation of psychology from the other sciences. Even those who have done the most are representatives of such a movement, not causes of it. In the article in question it is stated that "under the influence of these men [those who received their training under President Hall] departments of experimental psychology and laboratories were founded at Harvard, Yale, Philadelphia, Columbia, Toronto, Wisconsin and many other higher institutions of learning." Professor James introduced experimental psychology at Harvard University, Professor Ladd at Yale University and Professor Baldwin at the University of Toronto, and their names do not appear on President Hall's list of former students. I began the work at the University of Pennsylvania with the coöperation of Professor Fullerton (where it is continued by one of our former students, Professor Witmer), and at Columbia College with the coöperation of Professor Butler. I am glad to have had the privilege of studying for four months under Dr. Hall at Johns Hopkins University, but I had previously studied for two years under Lotze and Wundt and held an appointment at Johns Hopkins University for some months before Dr. Hall was called as lecturer to that University. The other men mentioned first on President Hall's list—Professors Dewey, Jastrow (who began the work at the only remaining university mentioned) and Donaldson—were also members of Johns Hopkins University before Dr. Hall.

In the same editorial article it is stated that *The American Journal of Psychology* wishes to publish especially 'the results of experimental investigations in psycho-physic laboratories,' an 'Archiv function not yet represented by any serial publication in this field in English.' It is, however, easy to verify the fact that during the past two years *The Psychological Review* has published some forty-two experimental investi-

gations in psychology whereas *The American Journal* has published but twenty-seven.

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THE RADIOLARIAN EARTHS OF CUBA.

TO THE EDITOR OF SCIENCE: The occurrence of Radiolarian earths in the land structure of the West Indian region has been of special interest to geologists, owing to the fact that they probably represent profound organic sediments of the deeper floor of the sea. The discovery of these earths in Barbados and Trinidad had excited wide interest, but little light had been obtained upon the important question of their geologic age.

In my recent papers* on the geology of the Island of Cuba, I have briefly described the geology of some interesting beds of siliceous earths which I collected from a locality in the suburbs of the town of Baracoa, and personally determined with the microscope to be composed of radiolarian remains. Through the determinations by Dr. Dall of fossils collected by me from the overlying strata, I was enabled to point out the important fact that they occurred immediately below strata containing fossils of undoubted Miocene age, and published a figure illustrating their geologic relations.

I was not aware at the time of making this publication that the existence of radiolarian beds in Cuba, much less at this particular locality, was known, as they are not mentioned in Professor Crosby's paper,† the only one previous to mine based on personal studies of the region.

In an article on the geology of the Barbados (to which Mr. J. W. Spencer has called my attention) by Mr. A. J. Jukes-Browne, published in the *Quarterly Journal of the Geological Society of London* for May 2, 1892, p. 221, the following interesting paragraph occurs:

"Cuba.—When this paper was read, Mr. J. W. Gregory was able to announce, from the examination of rocks he had obtained from Baracoa in Cuba, that radiolarian earths existed in that island; he finds them to be similar in structure

* *American Journal of Science*, September, 1894. Notes on the Geology of the Island of Cuba. Based upon a reconnaissance made for Alexander Agassiz, Cambridge, Mass.

† On the Elevated Coral Reefs of Cuba. *Proc. Boston Society of Natural History*, Vol. XXII., pp. 124-129.

and mode of occurrence, and also in their calcareo-siliceous varieties, to those of Barbados."

This previous publication clearly entitles Mr. Gregory to the original announcement of the radiolarian earths in Cuba, and had I known of its existence he should have received credit therefor in my papers, and my work has only resulted in the approximate determination of their age and mode of occurrence. The nature of Mr. Gregory's discovery is more fully explained, however, in a recent paper* in which he clearly sets forth the fact that he found these rocks, not in Cuba, but in Boston, in the collection made by Prof. W. C. Crosby in the Museum of Natural History, and refers to my preliminary paper for the facts concerning their occurrence and age. In this paper he also presents an interesting paleontologic study of this material showing the presence of 17 families, 25 genera and 33 species.

These are the facts concerning the knowledge of the radiolarian beds of Cuba: The material was first collected by Professor Crosby; their radiolarian nature determined from Professor Crosby's collections in Boston by Mr. Gregory; their geological occurrence and age described by the writer from studies on the ground, and their specific paleontology determined by Mr. Gregory.

On page 311 of Vol. 51 of the Quarterly Journal of the Geological Society of London, dated August, 1895, as a portion of the discussion following the delivery of Mr. J. W. Gregory's article on the Paleontology and Physical Geology of the West Indies, Mr. A. J. Jukes-Browne is quoted as follows:

"In view of these facts, we are quite prepared to accept Mr. Gregory's conclusion that the Oceanic Series is of Miocene age, the more so as Mr. Spencer has come to the same conclusion with respect to the Radiolarian Earths of Cuba, after a personal study of the geology of that island."

Inasmuch as Mr. Spencer makes no claim of having ever visited eastern Cuba, and has only seen the material from Baracoa which the writer collected, the above paragraph is liable to convey an erroneous impression concerning

* Paleontology and Physical Geology of the West Indies. Quarterly Journal of the Geological Society of London, August, 1893, pp. 293-95.

the discovery of the age and existence of these important beds.

ROBT. T. HILL.

WASHINGTON, D. C., October 16, 1895.

ERECT VISION AND SINGLE VISION.

PROF. CATTELL'S criticism of Prof. Brooks (SCIENCE for October 11, p. 487) in the matter of the inverted retinal image is undoubtedly just, but his reply has not made things any clearer. There is nothing specially inconceivable nor specially inexplicable about erect vision with inverted retinal image. It can be explained, too, without 'standing the soul on its head.' This may be a metaphysical but surely not a scientific explanation. In science what we mean by an explanation is a reducing of the phenomena in question to a law, which includes many other phenomena and especially the most common and familiar phenomena. Now, the seeing things in their natural or real position by means of inverted retinal images is a necessary result of the *law of direction*, and this law is the most familiar fact of common sensation. Let me explain:

Suppose I was standing on the plains of Arizona, captive, bound and blindfolded, surrounded by Apaches and a target for their arrows. I think I could tell with reasonable certainty the general direction of the Apache who shot any particular arrow. I would know it by the part struck and especially by the direction of the push of the arrow. I would refer the cause back along the line of the push to the proper place. There is nothing especially inconceivable in this. Now, suppose I look at the horizon. A star (I take this because it is a point) sends its ray into my eye through the optic center or nodal point, and it strikes a certain rod or cone on the lower half of the retinal concave. Is it anything specially strange that the impression—the punch—should be referred back along the line of the punch (ray line) to its proper place in space and, therefore, that I should see the star *above* the horizon? Now, objects are made up entirely of such stars—*i. e.*, radiant points—each sending its ray straight to the retinal concave, all crossing one another at the nodal point and therefore making an inverted image. But *each focal impression* (focal point) of the image is referred back along its own